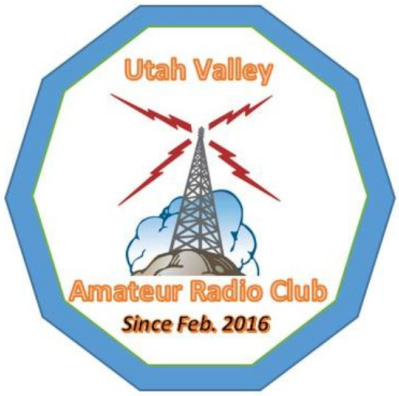
DIY

Worthwhile projects you can build on your own



160-meter pennant antenna

In the aftermath of World War I, there was a large development effort in search of a way to listen to distant signals, in spite of all the surrounding noise. The Beverage antenna was a result of that development, but it was a very large antenna, some on the order of a half mile to three miles long. Many felt that a much smaller antenna could be made with the same or close receiving ability and SNR (signal-to-noise ratio), which the Beverage antenna was known for.

The ***pennant antenna*** was just such an antenna, which exhibited a similar SNR, only much smaller in size. Because the pennant antenna is primarily a receive antenna, the challenge here is whether we can modify the original design to work satisfactorily as a transmitting antenna as well. This model is patterned after the single-pennant versions by Gary Nichols KD9SV and Earl Cunningham K6SE.

Parts list

75 feet of 14 AWG stranded insulated wire

One BN-73-202 "binocular" ferrite core

Two small pieces of hard plastic

Four 10-foot 1″ schedule 80 PVC

Nine 14 AWG #8 stud ring terminals

4 each M3 screws, split washers, nuts

One SO-239 bulkhead connector

40 inches of 30 AWG insulated wire

One 910-ohm 5W resistor

Two 36″ round stakes

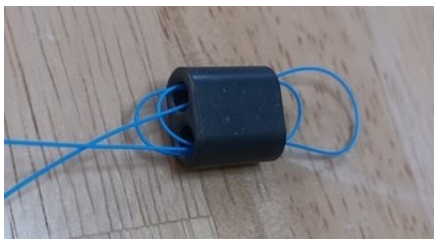
Six #8-32 screws, nuts, split washers

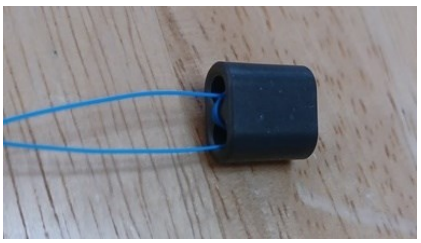
Hot glue and gun

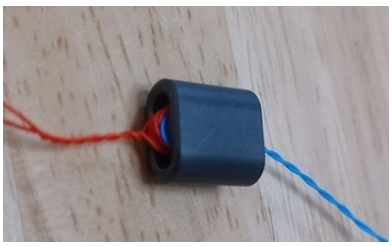
Transformer and connector assembly

The pennant antenna is completely isolated electrically from ground, and so requires the construction of a 4:1 *isolation transformer*. This device keeps the feed line electrically separate from the rest of the antenna, and so must be wound with two separate wires, one pair connected to the coax and the other to the antenna elements.

Start by tightly winding ***three turns*** of the blue wire around the middle of the core, both ends of the wire protruding from different holes on the same end, then pull them tight. Next, tightly wind ***twelve turns*** of the red wire around the same core, but from the other end, again such that both ends of the red wire protrude from different holes on the same end, then pull them tight. Twisting the wires is not necessary; I only did it to keep them from loosening. Strip about ¼″ off all four wire ends.







DIY, continued

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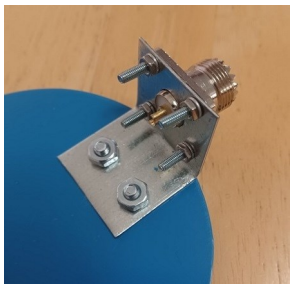
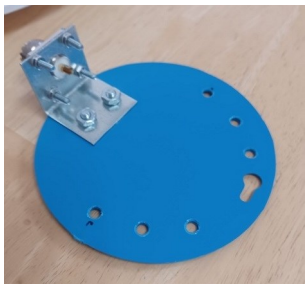
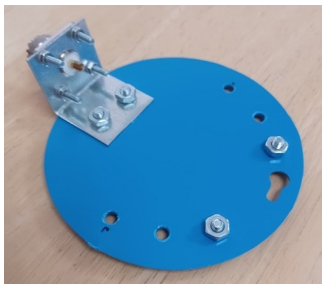
Install the SO-239 bulkhead onto a piece of scrap sheet metal strap (I actually purchased a vent hanger), about 1-¼″ wide, using a 7/16″ hole for the center. Drill out four 1/8″ mounting holes, deburr the holes, and install the bulkhead using the M3 screws, washers, and nuts to hold it in place. Bend the bulkhead part of the strap to lead the coax away from the antenna and to keep the coax shield as far from the transformer as possible.

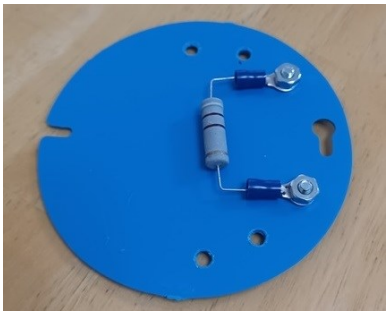
Drill out two 3/16″ mounting holes in both the strap and one of the hard plastic pieces, then Install the strap onto the plastic piece by two #8 screws, nuts, and split washers. Drill out two more 3/16″ holes in the plastic piece, 90° away from the bulkhead connector and ½″ from the edge, then four more, each ¾″ apart and ½″ from the edge. Drill out the same pattern on the second plastic piece. Deburr all drilled-out holes to protect the wire elements. Install two #8 screws, nuts, and split washers in the holes closest together in each plastic piece.







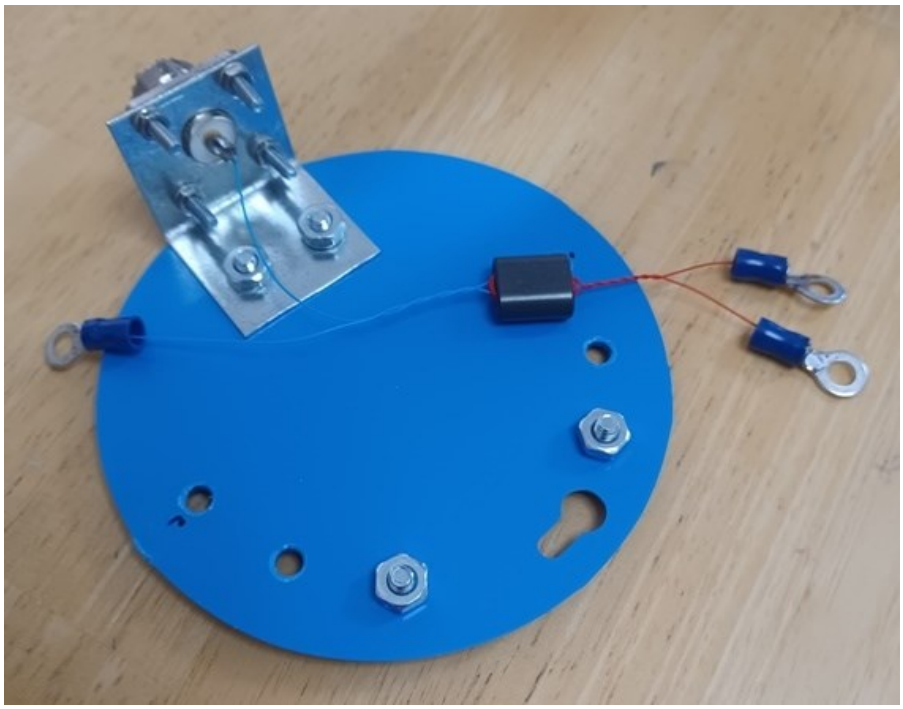
Solder the 910-ohm resistor to a pair of #8 ring terminals. Attach the resistor terminals to the two #8 screws on the second plastic piece.



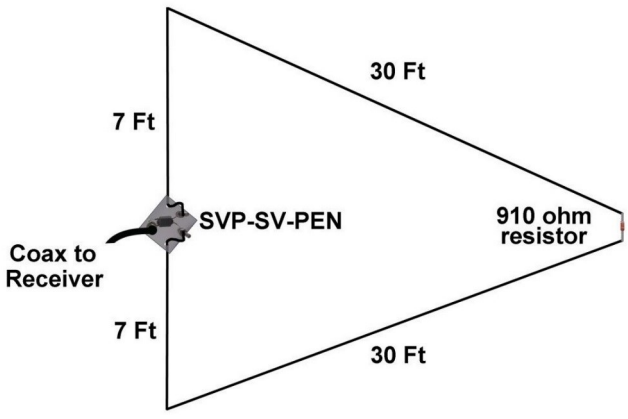
DIY, continued

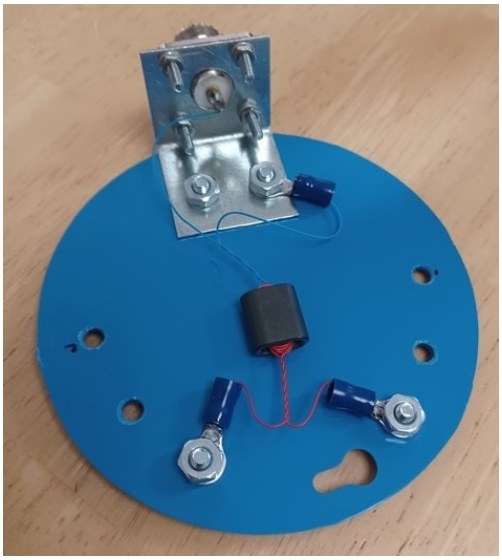
160-meter pennant antenna

Solder #8 ring terminals to both red transformer wires, and another to one of the blue wires. Solder the remaining blue wire to the solder cup of the SO-239 bulkhead connector. Attach the binocular transformer to the plastic piece with a dab of hot glue. Attach the ring terminals of the red wires to the #8 screws on the plastic piece, and the ring terminal of the blue wire to one of the #8 screws holding the strap to the plastic piece.



Here's a diagram of what we're trying to accomplish, by the way (the SV-PEN is a DX Engineering product):





DIY, continued

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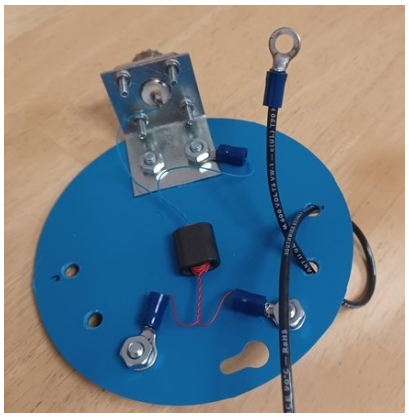
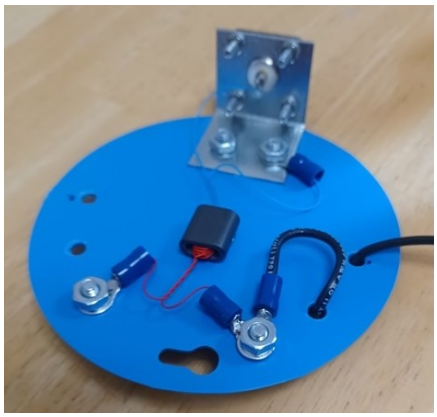
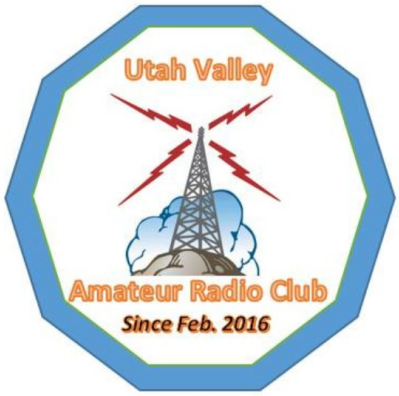
Assemble the wire elements

Cut two (exactly) 37-foot 0-inch pieces of 14 AWG wire for the elements. Thread one of the element wires through one of the two drilled holes in the first plastic piece farthest from the #8 screw, then through the second hole. Solder a #8 ring terminal to the wire, then attach the ring terminal to the #8 screw and secure it. Repeat this for the other element. Attach the other ends of the element wires to the second plastic piece in the same manner.







DIY, continued

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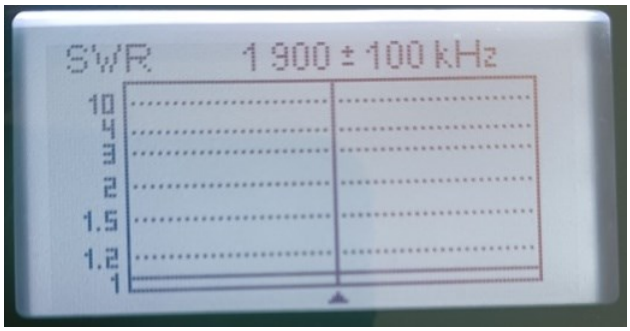
Testing the pennant

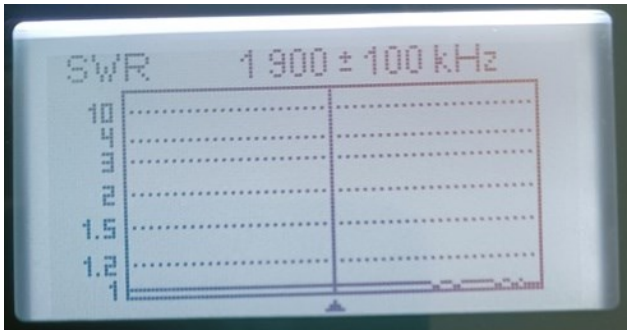
Admittedly, the pennant antenna is a bit of a chore to install, because it needs to maintain its "pennant flag" shape well above ground level, and clear of anything metal. Once it was in place, I applied the analyzer, and got a surprising result:



When somebody shows me an analyzer result like this, experience tells me right away that something is probably wrong. A low SWR across the band is terrific, but *completely flat*? Honestly, if it's too good to be true, it's likely a false positive.

So, I decided to re-calibrate my analyzer, then hook it up (using the same coax, to eliminate that possible failure point) to a 100-ohm test load. If all goes well, the analyzer is expected to read 100 ohms ÷ 50 ohms = 2.0:1 SWR across the band. To the right is the result from my analyzer following the re-calibration:

As you can see, the analyzer reads as expected, with a nearly flat line across the band right at 2.0:1 SWR. Perfect. Now, armed with a re-calibrated analyzer, I connected it to the pennant antenna again, and got this result:



I couldn't believe my eyes. The new reading was actually slightly better than the first, with the SWR improving toward the higher end of the band. In all my years, I have never built an antenna with an SWR this low across the entire band. And on the first try...I never needed to modify or tune the antenna even the slightest.

To be honest, I have not yet tried this antenna on the air, so I really won't know if it actually works until I do. Still, it looks promising.

Summary

The 160-meter pennant is a balanced, ungrounded antenna that was originally designed as a receiving antenna. But, with some re-designing using a termination resistor and a 4:1 isolation transformer, we can turn it into a transmitting antenna that exhibits surprisingly low SWR across the band. It was easy to build, but a little difficult to erect, but analyzed like a charm. The jury's still out on it until I can actually use it on the air, so stay tuned.

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